Gender Differences in Physical Disability Among an Elderly Cohort

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Objectives. We analyzed the role of sociodemographic factors, chronic-disease risk factors, and health conditions in explaining gender differences in disability among senior citizens.

Methods. We compared 1348 men and women (mean age = 79 years) on overall disability and compared their specific activities of daily living, instrumental activities of daily living (IADL), and mobility limitations. Analysis of covariance adjusted for possible explanatory factors.

Results. Women were more likely to report limitations, use of assistance, and a greater degree of disability, particularly among IADL categories. However, these gender differences were largely explained by differences in disability-related health conditions.

Conclusions. Greater prevalence of nonfatal disabling conditions, including fractures, osteoporosis, back problems, osteoarthritis and depression, contributes substantially to greater disability and diminished quality of life among aging women compared with men. (*Am J Public Health.* 2004;94:1406–1411)

Although aging women experience lower mortality rates and lower rates of some chronic diseases (e.g., coronary and pulmonary disease) and use health care services more often than men,[1–4] they consistently report more functional limitations and physical disability than their male counterparts.[2,4–12] It has been hypothesized that the greater prevalence and severity of arthritis and musculoskeletal disease among older women explain some, but not all, of the latter difference.[3,6,13–15] It also has been hypothesized that differences may arise because of psychosocial factors, i.e., women by nature may be more likely to report or overreport ill health and disability and men may underreport their infirmities.[1,4,6,15] While there is a substantial amount of literature that describes gender differences in chronic health conditions and other health outcomes, studies that have specifically examined gender differences in physical disability are more limited,[2,5,9–11,14,16] particularly those that have attempted an in-depth analysis aimed at understanding the reasons for these disparities, including the possible role of sociodemographic factors, chronic-disease risk factors, and specific health conditions.

We followed a cohort of elderly men and women to identify risk factors associated with physical functioning and to address gender disparities in greater detail. Over the lifetime of this study (1986–1999), the gender gap in disability was small but evident as early as 65 years of age, and the gap continued to widen into old age. Thus, our study was designed to (1) examine differences in overall physical functioning among men and women and differences in specific activities of daily living (ADLs), instrumental activities of daily living (IADLs) and mobility; (2) examine differences in the use of assistance; and (3) determine whether differences in sociodemographic factors, chronic-disease risk factors, and health conditions explain the gender disparities.

METHODS

The study cohort comprised 1348 elderly men and women who were part of the Alumni Health Study and who had been participating in a longitudinal study of risk factors for physical disability since 1986. Participants who were at least 60 years of age and who lived in the United States responded to yearly questionnaires that included information on health behaviors, risk factors, medication use, health status, medical conditions, physical disability, and quality of life. Data were collected from individual self-reports; participants who had difficulty completing a questionnaire were offered telephone assistance, but surrogates rarely submitted the questionnaire for intended respondents. We analyzed those respondents who completed a questionnaire in 1999, the final year in which data were collected on a number of factors that are potentially associated with disability. The later years of the original study (1999–2001) also showed the greatest percentage and degree of disability among the cohort. Further details of the original study design and population have been published elsewhere.[17,18]

The Health Assessment Questionnaire, a reliable and validated self-assessment instrument,[19] was used to obtain functional-status information and to score a measure of overall disability. Participants were asked to rate their degree of difficulty in performing ADLs and IADLs and difficulty with mobility by answering 20 questions that represented 8 categories of physical functioning: dressing/grooming, arising, eating, walking, hygiene, reaching, gripping, and doing errands/chores. Perceived difficulty in performing each activity during the past week was scored as 0 (no difficulty), 1 (some difficulty), 2 (much difficulty), or 3 (unable to do). The activity with the greatest perceived difficulty within a particular functional category determined the category score. An overall disability index that ranged from 0 (no disability) to 3 (most severe disability) was obtained by averaging the 8 category scores. Thus, some difficulty in only 1 of the 8 categories was scored 0.125, the minimal level of disability. A score of 0.375 represented either complete inability in 1 category or lesser difficulties in 2 or 3 categories. As a result, seemingly small numeric differences in scores could have a big impact on physical function. Separate scores for limitations in ADLs (self-care activities, including dressing/grooming, eating, and hygiene), IADLs (functioning in the immediate environment, including reaching, gripping,

and doing errands/chores), and mobility (arising, walking) were similarly computed.[20]

Participants also indicated if they used an aid, device, or help from another person within each functional category. Aids and devices by category included (1) dressing/grooming—button hook, zipper pull, long-handle shoe horn, etc.; (2) arising—built up or special chair (higher seat or arms or both), cane; (3) eating—built up or special utensils (thicker or longer handles or both); (4) walking—cane, walker, crutches, wheelchair; (5) hygiene—raised toilet seat, bathtub seat, bathtub bar, long-handled appliances in bathroom, etc.; (6) reach—long-handled appliances; (7) gripping—jar opener (for jars previously opened); and (8) doing errands/chores—any of the aids and devices for the first 7 categories. Participants listed any other aids or devices that were used but were not specified on the questionnaire.

The variables we examined to potentially explain gender differences were those associated with disability in this and other studies:

(1) Sociodemographic characteristics—age, years of education, and annual household income.

(2) Chronic-disease risk factors—body mass index (BMI; calculated as weight in kilograms divided by height in meters squared), BMI^2 (reflected a curvilinear relationship in this and other older cohorts), smoking history (cigarette pack-years), and drinks per week (beer, wine, and hard liquor). Data on weekly time engaged in moderate or vigorous physical activity and miles walked per day were collected but were not analyzed as explanatory factors because of the close correspondence between activity levels and disability measured at the same point in time.

(3) Medical history—arthritis, osteoporosis, chronic back problems, fractures in the past year, any joint pain lasting 6 weeks and specific locations of such joint pain, cardiovascular disease, pulmonary disease, neurological disorders, diabetes, vision and hearing difficulties, depression, and number of prescription medications to assess the degree of infirmity.

Differences between men and women in measures of disability, use of assistance, and possible explanatory factors were evaluated by t and χ^2 tests, as appropriate, with SAS, version 8.02, software (SAS Institute Inc, Cary, NC). Multivariable analysis of covariance was used to adjust gender-specific mean disability scores for possible explanatory factors. These analyses proceeded in a staged fashion to examine the contributions of sociodemographic factors alone, chronic-disease risk factors, and then health conditions and gender-disease interactions to gender differences. Because of the ordinal, non-normal distribution of the disability score, we also performed analyses with a cumulative logit model, which confirmed our results about gender differences and associated explanatory factors.[21]

RESULTS

Our initial results showed that women compared with similarly aged men were significantly more likely to report functional limitations (overall 52% vs 37%, $P<.001$) and had significantly greater degrees of disability (overall mean 0.30 vs 0.18, $P<.001$) (Table 1). Women also reported limitations in more of the 8 functional categories than did men (1.8 vs 1.1, $P<.001$) (data not shown). Mean scores within each functional category indicated that the most significant differences between women and men were in the IADLs (1.7 to 3.0 times greater among women, $P<.001$), e.g., reaching, gripping, and doing errands/chores. Differences in mobility functions were less pronounced (1.5 times greater among women) but still significant ($P<.01$), and differences in ADLs were evident in only 1 of the 3 categories assessed (hygiene, $P<.05$). Gender differences in the percent who reported limitations also were significant in 7 of the 8 categories of physical function (there were no reporting differences or differences in mean scores for the dressing/grooming function). In contrast, for women and men who reported limitations, the scores were not statistically different in any of the 8 categories. Thus, although more women than men reported category-specific limitations, the degree of impairment for those who had limitations in each category was similar for both women and men.

Gender differences in the use of aids, devices, or help from another person are shown in Table 2. Interestingly, women were significantly more likely than men to report the use of assistance for any of the 8 functional categories, whether or not they reported limitations. Among the group that had no disability, twice as many women as men (14% vs 7%, $P<.01$) used assistance for at least 1 functional category. Among the group that had some disability, the difference was 64% versus 48%, respectively ($P<.001$). These differences were evident only at disability levels less than or equal to 1.0, because at greater levels, almost 100% of the cohort used assistance (data not shown). The specific functional categories that showed significant male-female differences were the same for those who did and did not have limitations: hygiene, reaching, and gripping ($P<.05$). Within the hygiene category, women were more likely than men to use aids and devices but not help from another person (data not shown). Again, the greatest differences in use of assistance between men and women (more than 2.5 times greater among women) were in the IADL categories of reaching and gripping.

We examined characteristics of the cohort to identify factors that might contribute to the gender differences in disability (Table 3). Because the population sampled were university students during the late 1930s and early 1940s, the men and women were predominantly White, highly educated, and close in age (mean age=79 years). Other sociodemographic indicators favored the men, including being married (85% of men vs 47% of women) and having greater annual household income. However, men were heavier smokers and drinkers ($P<.001$), while women were more likely to be obese ($P<.01$). With regard to medical history, women had significantly more chronic health conditions during the past year and were taking more prescription medications than men ($P<.05$). Additionally, women reported conditions that were potentially physically disabling more often than men, including osteoarthritis ($P<.001$), osteoporosis ($P<.001$), chronic back problems ($P<.05$), and fractures ($P<.01$). They also had more pain and stiffness in their muscles and joints and more physical fatigue than men (data not shown). Cardiovascular disease was the only condition that was significantly more prevalent among the men.

TABLE 1—Gender Differences in Prevalence and Degree of Disability, by Functional Category

Functional Category	Functional Category Mean Disability Score (SE)		Some Limitations in Functional Category, %		Functional Category Mean Disability Score (SE) Among Those Who Have Limitations	
	Men (n = 1044)	Women (n = 304)	Men (n = 1044)	Women (n = 304)	Men	Women
Dressing/grooming	0.17 (0.02)	0.23 (0.03)	13.2	17.1	1.29 (0.06)	1.35 (0.10)
Arising	0.22 (0.02)	0.34 (0.04)**	19.2	27.6**	1.15 (0.03)	1.23 (0.06)
Eating	0.20 (0.03)	0.30 (0.05)	6.0	11.8***	1.24 (0.07)	1.31 (0.10)
Walking	0.26 (0.02)	0.39 (0.04)**	18.6	27.3***	1.37 (0.05)	1.41 (0.08)
Hygiene	0.09 (0.01)	0.16 (0.03)*	8.1	12.8*	1.10 (0.04)	1.21 (0.08)
Reaching	0.25 (0.02)	0.43 (0.04)***	19.0	31.6***	1.32 (0.05)	1.35 (0.07)
Gripping	0.05 (0.01)	0.15 (0.03)***	4.2	11.2***	1.23 (0.09)	1.32 (0.11)
Doing errands/chores	0.34 (0.02)	0.58 (0.05)***	23.6	40.1***	1.46 (0.05)	1.44 (0.07)
Overall	0.18 (0.01)	0.30 (0.03)***	37.4	51.6***	0.49 (0.02)	0.59 (0.04)*

*P < .05; **P < .01; ***P < .001.

TABLE 2—Gender Differences in Reporting Use of Help From Aids, Devices, or Another Person, by Functional Category and Limitation Status

Functional category	Reporting Use of Help			
	No Limitations in Functional Category, %		Some Limitations in Functional Category, %	
	Men	Women	Men	Women
Dressing/grooming	1.8	0	14.9	12.7
Arising	0	0	4.1	6.4
Eating	0	0	1.8	3.2
Walking	1.1	0.7	23.3	28.0
Hygiene	4.1	8.2*	27.2	38.9**
Reaching	0.2	3.4***	9.2	25.5***
Gripping	0.3	2.0*	11.0	28.0***
Doing errands/chores	0.5	1.36	22.1	29.3
Any of the 8 categories	7.0	14.3**	47.7	64.3***

*P < .05; **P < .01; ***P < .001.

Results of multivariable analyses that examined the influence of sociodemographic factors, chronic-disease risk factors, health conditions, and gender-disease interactions on the gender difference in overall disability are shown in Table 4. Findings indicate that the gender difference in mean disability remained statistically significant (P<.001) after we adjusted for both sociodemographic factors and chronic-disease risk factors. However, when adjustments also were made for specific comorbid health conditions and prescription medications, the resultant mean disability scores for men and women were essentially identical (mean=0.21). Results were similar when the number of prescription medications, which was used as a general measure of degree of comorbidity, was excluded from the model (mean disability=0.22 for women and 0.21 for men, P=.71), which indicated that the specific health conditions had the greatest impact. The conditions that were significantly associated with disability in our analyses included (in order of importance) neurological disease, hip or lower-extremity joint pain, bone fractures (P<.001 for all), back/neck/shoulder joint pain (P<.01), osteoarthritis, chronic back problems, osteoporosis, and depression (P<.05 for all) (data not shown). Greater disability also was associated with use of more prescription medications, greater age (P<.001 for both), lower income, less alcohol consumption (P<.01 for both), and both low and high BMI (P<.05). Tests of the gender-disease interactions indicated a significantly greater association of fractures and back/neck/shoulder joint pain with disability among women compared with men. Separate multivariable analyses also indicated that there were no remaining gender differences in ADL, IADL, or mobility limitations after we controlled for these same health conditions (data not shown).

We used a cumulative logit model to address the ordinal, non-normal distribution of the disability outcome. The results of our analysis confirmed the initial finding that chronic health conditions explained the gender difference in disability. The significance levels of possible explanatory factors were almost identical to those in the analysis of covariance for each variable, with the exception that osteoporosis was not statistically associated with disability in the logit modeling.

DISCUSSION

The comorbid conditions associated with disability among this cohort, which were predominantly musculoskeletal, neurodegenerative, and psychological in origin, were generally more prevalent among women than

TABLE 3—Sociodemographic Factors, Chronic-Disease Risk Factors, and Health Conditions, by Gender[a]

	Men (n = 1044)	Women (n = 304)
Age, mean y (range 73–99)	79.0 (0.1)[a]	78.9 (0.2)
Married, %	85.0	46.7***
Education level, mean y	17.5 (0.1)	17.3 (0.9)
Annual income, mean $	75 848 (824)	61 673 (1794)***
Body mass index (BMI), mean kg/m^2	24.8 (0.1)	24.2 (0.3)*
Obese (BMI ≥ 30), %	6.1	11.5**
Current smoker, %	2.0	1.6
Cigarette pack-years, mean	20.1 (0.9)	13.2 (1.3)***
Alcoholic drinks per week, mean	5.4 (0.2)	3.1 (0.3)***
Moderate or vigorous physical activity, %	69.2	64.5*
Miles walked per day, mean	1.3 (0.03)	1.3 (0.06)
No. of medical conditions, mean	2.4 (0.1)	2.8 (0.1)*
No. of prescription medications, mean	3.1 (0.1)	3.5 (0.2)*
Overnight hospital stays, mean	1.8 (0.1)	0.9 (0.2)
Osteoarthritis, %	15.2	27.6***
Rheumatoid arthritis, %	5.0	4.6
Duration of arthritis, mean y	15.0 (1.1)	19.1 (1.8)*
Osteoporosis, %	1.9	22.7***
Chronic back problems, %	12.3	17.8*
Any musculoskeletal problems, %	39.9	55.6***
Fracture in past year, %	2.6	6.3**
Joint pain for 6 weeks, %	42.8	43.4
Finger/hand/arm pain, %	16.6	19.1
Back/neck/shoulder pain, %	25.3	28.0
Feet/leg/hip pain, %	24.6	29.6
Cardiovascular disease, %	45.2	38.5*
Pulmonary disease, %	9.5	9.2
Neurological disorders, %	5.5	7.2
Diabetes, %	8.1	5.6
Vision/hearing difficulties, %	34.2	41.8*
Depression, %	3.3	4.0

[a]Values in parentheses denote standard errors.
*P < .05; **P < .01; ***P < .001.

among men, as documented by others,[1–5,10,14] and served, along with greater prescription medication use, to explain the reported higher levels of overall disability and the IADL, ADL, and mobility limitations among women. While lower income, less alcohol consumption, and high and low BMI were associated with disability and were more common among women in this cohort, after we controlled for these factors alone, the observed gender differences did not diminish. It is clear that ascertainment of and adjustment for the relevant concomitant health problems provided a basis for the detailed examination of gender differences in our study. Although few studies of disability have used such extensive information on health problems to effectively address the question,[2,5,8–11,16] our results are consistent with others that suggest that gender differences in function (disability) are caused by women's greater prevalence of mostly nonfatal but disabling conditions.[1–4,16]

Osteoarthritis is the leading chronic health condition for older adults in the United States.[22] It affects a greater proportion of women and is reported to be more disabling for women than for men.[4,13,23] While osteoarthritis and chronic joint pain were the most prevalent conditions associated with disability in our study, the analyses further indicate that they were not the only or the most important explanatory health factors. Additional multivariable analyses that looked at the association of sociodemographic factors, chronic-disease risk factors, and osteoarthritis and joint pain variables with overall disability showed that gender differences narrowed but remained unexplained by these factors (disability mean=0.25 for women and 0.20 for men, P=.04). Previous analyses also indicated that certain health problems that were significantly more prevalent among women—greater medication use, fractures, osteoporosis, and chronic back problems—appeared to be more strongly associated with disability than osteoarthritis. Verbrugge et al. also noted that some of these conditions had a greater relative impact on disability than arthritis.[9,15] Neurological disorders—including Parkinson's disease, multiple sclerosis, dementia, and Alzheimer's disease—and depression were clearly associated with disability but were only somewhat more common among women than among men. These findings suggest that a greater variety of acute and chronic health conditions contribute substantially to gender differences in disability and to quality of life among aging men and women.

The self-report nature of the data on physical limitations and health problems in our study raises the question of whether women may have similarly overreported (or men underreported) both types of information, which may have resulted in spurious findings regarding gender differences and explanatory comorbid conditions. However, validation studies of disability measured by the Health Assessment Questionnaire have shown good correlations (r=0.88) of scores obtained by questionnaire versus medical evaluation of activity performance, with no apparent differences in validity between men and women.[10,18] Additionally, a 1998 validation study of self-report among this cohort compared participant-reported conditions to those noted in the medical record by the participants' physicians (unpublished data). After we adjusted for physician reporting and age, there were no statistically significant differences between men

TABLE 4—Gender Differences in Disability After Adjustment for Sociodemographic Factors, Chronic-Disease Risk Factors, and Health Conditions: Results of Multivariable Analysis of Covariance

	Mean Disability Scores (SE)		
	Adjusted for Age and Sociodemographic Factors[a]	Adjusted for Age, Sociodemographic Factors, and Chronic-Disease Risk Factors[b]	Adjusted for Age, Sociodemographic Factors, Chronic-Disease Risk Factors, and Health Conditions[c]
Men	0.19 (0.01)	0.19 (0.01)	0.21 (0.01)
Women	0.29 (0.02)*	0.28 (0.02)*	0.21 (0.02)

[a]Sociodemographic factors include educational level and total annual income.
[b]Risk factors include alcohol use, cigarette pack-years, body mass index (BMI), and BMI^2.
[c]Health conditions include osteoarthritis, rheumatoid arthritis, duration of arthritis, osteoporosis, neurological disorders, cardiovascular disease, pulmonary disease, diabetes, vision/hearing problems, depression, finger/hand/arm pain, feet/leg/hip pain, back/neck/shoulder pain, chronic back problems, bone fractures, and number of prescription drugs.
*$P < .001$.

and women in any of the disease conditions assessed, including cardiovascular disease, pulmonary conditions, arthritis, other musculoskeletal disease, cancer, and vision/hearing problems. There also were no differences between the 2 groups in the total number of conditions reported. Another investigation of gender differences that compared self-reported disability with performance measures concluded that men and women generally report their disabilities accurately, and the higher prevalence of functional problems among women is probably a reflection of true greater disability on most measures.[16]

Gender differences in disability also may have resulted from earlier mortality among men who had fatal disabling conditions. On the other hand, if there were early mortality among women from, for example, obesity-related diseases, this would serve to reduce some of the gender difference among the cohort before observation in this study. While data are not available on all eligible participants before study entry, there is data on disability for participants who died over the course of follow-up. Age-adjusted disability at study entry was 0.13 versus 0.20 among men and women who were deceased by 1999. These averages were significantly greater than those among individuals who were followed through 1999 (0.05 vs 0.09, respectively) or who dropped out of the study for other reasons (0.06 vs 0.10, respectively). However, the gender difference, or ratio of male to female disability, was quite similar among those who died, dropped out, or were followed, which indicates that any "selective mortality" among men, women, or both may have had a minimal impact on the gender differences observed in our analyses. Furthermore, selective mortality that reflects disabling comorbidity among either men or women would indicate an explanatory role of concomitant health conditions on gender differences and thus be consistent with our findings. Results from a previous study of gender differences in disability prevalence also minimized the impact of selective mortality.[12]

Other important results of our study indicate that while women reported more disability than men did in almost all of the 8 functional categories, and particularly in those related to IADLs and mobility, the differences were predominantly in the percentage who reported a limitation and not in the severity of the limitation once it was identified. Use of assistance also was greater among women than among men who did or did not have physical limitations, primarily in the IADL categories. These pronounced gender differences in IADL limitations are consistent with previous studies.[1,2,7,9,24] The fact that women needed more help than men with reaching and gripping, even when no limitations were reported, also indicates that factors unrelated to true disability, such as stature and strength, may have played a role. Differences in assistance with hygiene were apparent in the use of aids or devices and not in the use of help from another person. This finding may reflect the fact that 43% of these women, compared with 13% of the men, lived alone and could not depend on another person for help. Additionally, there may have been greater concern for the prevention of falls among women, particularly among those who did not have limitations, as has been suggested by others.[4]

CONCLUSIONS

While the homogeneity of this population with regard to race/ethnicity and education may limit the generalizability of these study findings, it served as a built-in control that strengthened our ability to draw inferences from the gender comparisons. Because physical disability caused by numerous disorders is the most prevalent major health problem of the elderly in the United States,[25,26] public health policies aimed at reducing the associated burden are important. Not only do women have more disabilities than men, they also live longer with diminished quality of life. Furthermore, they need more assistance from others and the health care system. However, nonfatal disabling conditions may not receive medical care commensurate with their frequency and their impact[27]; thus, women may be less likely to recover from an initial illness experience.[5,8,12] In addition to efforts at disease prevention, resources aimed at earlier identification and better case management of patients with potentially disabling conditions may serve to slow functional decline and diminish its burden on both the individual and society. ■

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H.B. Hubert was the principal investigator and supervised the analyses. K.N. Murtagh completed the data analyses, and both authors contributed to the writing of the article.

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